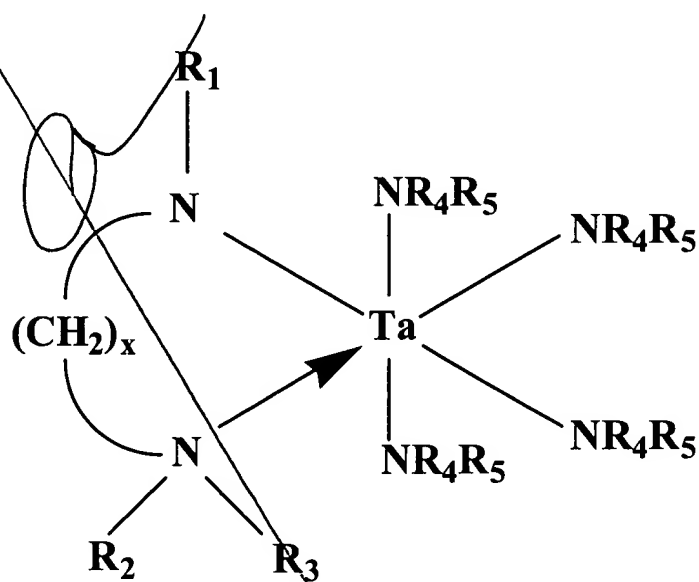


THE CLAIMSWHAT IS CLAIMED IS:

5 1. A source reagent composition comprising at least one tantalum and/or titanium species selected from the group consisting of:

(i) tethered amine tantalum complexes of the formula:



wherein:

x is 2 or 3;

each of $\text{R}_1\text{-R}_5$ is independently selected from the group consisting of H, $\text{C}_1\text{-C}_4$ alkyl, aryl, $\text{C}_1\text{-C}_6$ perfluoroalkyl and trimethylsilyl;

(ii) β -diimines of the formula:

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wherein:

G is a β -diimino ligand;

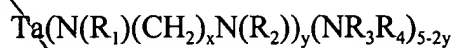
each Q is selected from the group consisting of H, C₁-C₆ alkyl, aryl and C₁-C₆

5 perfluoroalkyl; and

x is an integer from 1 to 4 inclusive;

(iii) tantalum diamide complexes of the formula

10



wherein:

x is 1 or 2;

y is 1 or 2;

each of R₁-R₄ is independently selected from the group consisting of H, C₁-C₄
15 alkyl, aryl, perfluoroalkyl, and trimethylsilyl;

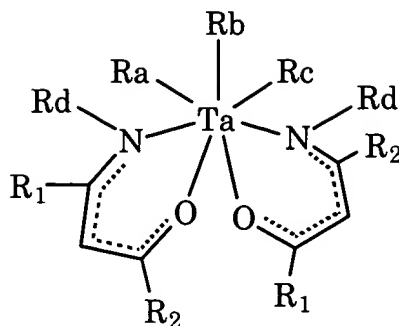
(iv) tantalum amide compounds of the formula



wherein each R and R' is independently selected from the group consisting of H,
20 C₁-C₄ alkyl, phenyl, perfluoroalkyl, and trimethylsilyl, subject to the proviso that in each

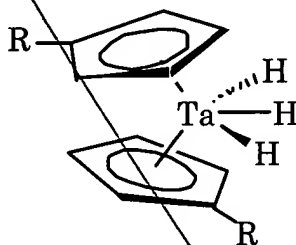
NRR' group, R R';

(v) β -ketoimines of the formula



wherein each of R_1 , R_2 , R_a , R_b , R_c and R_d is independently selected from H, aryl,
 5 C_1 - C_6 alkyl, and C_1 - C_6 perfluoroalkyl; and

(vi) tantalum cyclopentadienyl compounds of the formula:



10 wherein each R is independently selected from the group consisting of H, methyl, ethyl, isopropyl, t-butyl, and trimethylsilyl;

(vii) $Ta(NR_1R_2)_x(NR_3R_4)_{5-x} / Ti(NR_1R_2)_x(NR_3R_4)_{4-x}$

15 where each of R_1 , R_2 , R_3 and R_4 are independently selected from the group consisting of H, C_1 - C_8 alkyl, aryl, C_1 - C_8 perfluoroalkyl or a silicon-containing group selected from the

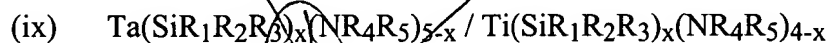
group consisting of silane, alkylsilane, perfluoroalkylsilyl, triarylsilane and alkylsilylsilane;



5

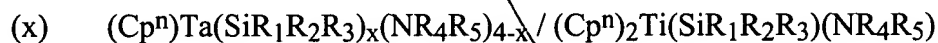
where each of R_1 , R_2 , and R_3 are independently selected from the group consisting of H, $\text{C}_1\text{-C}_8$ alkyl, aryl, $\text{C}_1\text{-C}_8$ perfluoroalkyl or a silicon-containing group selected from the group consisting of silane, alkylsilane, perfluoroalkylsilyl, triarylsilane and alkylsilylsilane;

10



where each of R_{1-5} is independently selected from the group consisting of H, Me, Et, ^tBu , Ph, ^iPr , CF_3 , SiH_3 , SiMe_3 , $\text{Si}(\text{CF}_3)_3$, $\text{Si}(\text{Et})_3$, $\text{Si}(^i\text{Pr})_3$, $\text{Si}(^t\text{Bu})_3$, $\text{Si}(\text{Ph})_3$, and $\text{Si}(\text{SiMe}_3)_x(\text{Me})_{3-x}$; and

15



where each of R_{1-5} is independently selected from the group consisting of H, Me, Et, ^tBu , Ph, ^iPr , CF_3 , SiH_3 , SiMe_3 , $\text{Si}(\text{CF}_3)_3$, $\text{Si}(\text{Et})_3$, $\text{Si}(^i\text{Pr})_3$, $\text{Si}(^t\text{Bu})_3$, $\text{Si}(\text{Ph})_3$, $\text{Si}(\text{SiMe}_3)_x(\text{Me})_{3-x}$ and Cp^n is $\text{C}_5\text{H}_x\text{Me}_{(5-x)}$ (where $x = 0-5$).

20

2. A source reagent composition according to claim 1, further comprising a solvent for said tantalum and/or titanium species.

3. A source reagent composition according to claim 2, wherein said solvent is selected from the group consisting of C₆-C₁₀ alkanes, C₆-C₁₀ aromatics, and compatible mixtures thereof.

5

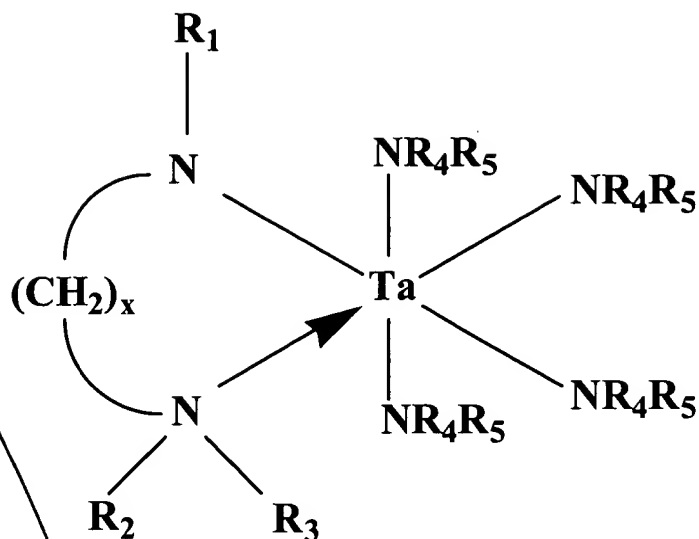
4. A source reagent composition according to claim 2, wherein said solvent is selected from the group consisting of hexane, heptane, octane, nonane, decane, toluene and xylene.

10

5. A method of forming Ta or Ti material on a substrate from a precursor, comprising vaporizing said precursor to form a precursor vapor, and contacting the precursor vapor with the substrate to form said Ta or Ti material thereon, wherein the precursor comprises at least one tantalum and/or titanium species selected from the group consisting of:

15

(i) tethered amine tantalum complexes of the formula:



wherein:

x is 2 or 3;

each of R_1 - R_5 is independently selected from the group consisting of H, C_1 - C_4

5 alkyl, aryl, C_1 - C_6 perfluoroalkyl and trimethylsilyl;

(ii) β -diimines of the formula:



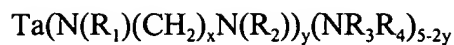
wherein:

G is a β -diimino ligand;

each Q is selected from the group consisting of H, C_1 - C_6 alkyl, aryl and C_1 - C_6 perfluoroalkyl; and

x is an integer from 1 to 4 inclusive;

(iii) tantalum diamide complexes of the formula



wherein:

x is 1 or 2;

5 y is 1 or 2;

each of R_1 - R_4 is independently selected from the group consisting of H, C_1 - C_4 alkyl, aryl, perfluoroalkyl, and trimethylsilyl;

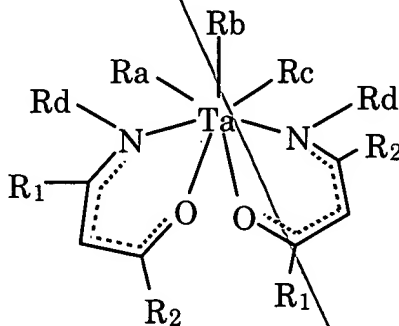
(iv) tantalum amide compounds of the formula



wherein each R and R' is independently selected from the group consisting of H, C_1 - C_4 alkyl, phenyl, perfluoroalkyl, and trimethylsilyl, subject to the proviso that in each

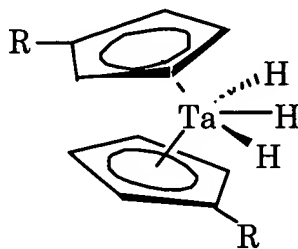
NRR' group, R R' ;

15 (v) β -ketoimines of the formula



wherein each of R_1 , R_2 , R_a , R_b , R_c and R_d is independently selected from H, aryl, C_1 - C_6 alkyl, and C_1 - C_6 perfluoroalkyl; and

(vi) tantalum cyclopentadienyl compounds of the formula



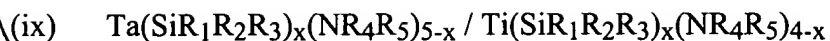
wherein each R is independently selected from the group consisting of H, methyl, ethyl, isopropyl, t-butyl, and trimethylsilyl;

(vii) $Ta(NR_1R_2)_x(NR_3R_4)_{5-x} / Ti(NR_1R_2)_x(NR_3R_4)_{4-x}$

where each of R_1 , R_2 , R_3 and R_4 are independently selected from the group consisting of H, C_1 - C_8 alkyl, aryl, C_1 - C_8 perfluoroalkyl or a silicon-containing group selected from the group consisting of silane, alkylsilane, perfluoroalkylsilyl, triarylsilane and alkylsilylsilane;

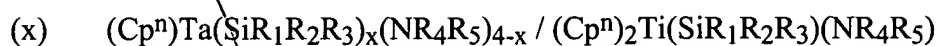
(viii) $Ta(NR_1)(NR_2R_3)_3$

where each of R_1 , R_2 , and R_3 are independently selected from the group consisting of H, C_1 - C_8 alkyl, aryl, C_1 - C_8 perfluoroalkyl or a silicon-containing group selected from the group consisting of silane, alkylsilane, perfluoroalkylsilyl, triarylsilane and alkylsilylsilane;



where each of R_{1-5} is independently selected from the group consisting of H, Me, Et, ^tBu,

5 Ph, ⁱPr, CF_3 , SiH_3 , SiMe_3 , $\text{Si}(\text{CF}_3)_3$, $\text{Si}(\text{Et})_3$, $\text{Si}(\text{iPr})_3$, $\text{Si}(\text{tBu})_3$, $\text{Si}(\text{Ph})_3$, and $\text{Si}(\text{SiMe}_3)_x(\text{Me})_{3-x}$; and

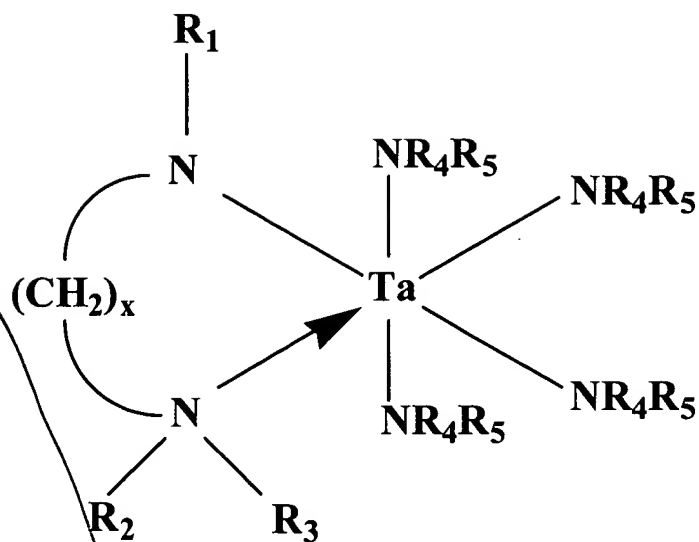


10 where each of R_{1-5} is independently selected from the group consisting of H, Me, Et, ^tBu,

Ph, ⁱPr, CF_3 , SiH_3 , SiMe_3 , $\text{Si}(\text{CF}_3)_3$, $\text{Si}(\text{Et})_3$, $\text{Si}(\text{iPr})_3$, $\text{Si}(\text{tBu})_3$, $\text{Si}(\text{Ph})_3$, $\text{Si}(\text{SiMe}_3)_x(\text{Me})_{3-x}$ and Cp^n is $\text{C}_5\text{H}_x\text{Me}_{(5-x)}$ (where $x = 0-5$).

6. A method according to claim 5, wherein said material formed on the
15 substrate is TaN, and the precursor is selected from the group consisting of:

(i) tethered amine tantalum complexes of the formula:



wherein:

X is 2 or 3;

each of R_1 - R_5 is independently selected from the group consisting of H, C_1 - C_4

alkyl, aryl, C_1 - C_6 perfluoroalkyl, and trimethylsilyl;

(ii) β -diimines of the formula:



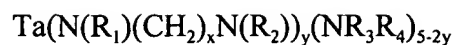
wherein:

G is a β -diimino ligand;

each Q is selected from the group consisting of H, C_1 - C_6 alkyl, aryl and C_1 - C_6 perfluoroalkyl; and

x is an integer from 1 to 4 inclusive;

(iii) tantalum diamide complexes of the formula



wherein:

x is 1 or 2;

5 y is 1 or 2;

each of R_1 - R_4 is independently selected from the group consisting of H, C_1 - C_4 alkyl, aryl, perfluoroalkyl, and trimethylsilyl;

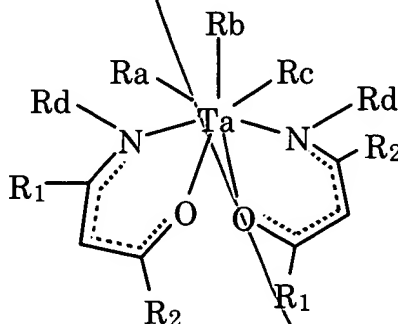
(iv) tantalum amide compounds of the formula



wherein each R and R' is independently selected from the group consisting of H, C_1 - C_4 alkyl, phenyl, perfluoroalkyl, and trimethylsilyl, subject to the proviso that in each

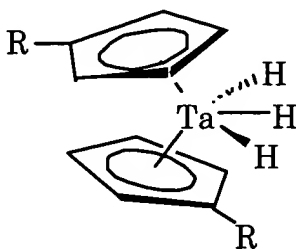
NRR' group, R R';

15 (v) β -ketoimines of the formula



wherein each of R_1 , R_2 , R_a , R_b , R_c and R_d is independently selected from H, aryl, C_1 - C_6 alkyl, and C_1 - C_6 perfluoroalkyl; and

(vi) tantalum cyclopentadienyl compounds of the formula



wherein each R is independently selected from the group consisting of H, methyl, ethyl, isopropyl, t-butyl, trimethylsilyl.

3/7. A method according to claim 1/5, further comprising a solvent for said precursor.

4/8. A method according to claim 3/7, wherein said solvent is selected from the group consisting of C_6 - C_{10} alkanes, C_6 - C_{10} aromatics, and compatible mixtures thereof.

5/10. A method according to claim 3/7, wherein said solvent is selected from the group consisting of hexane, heptane, octane, nonane, decane, toluene and xylene.

6/10. A method according to claim 1/5, comprising liquid delivery chemical vapor deposition of said precursor.

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